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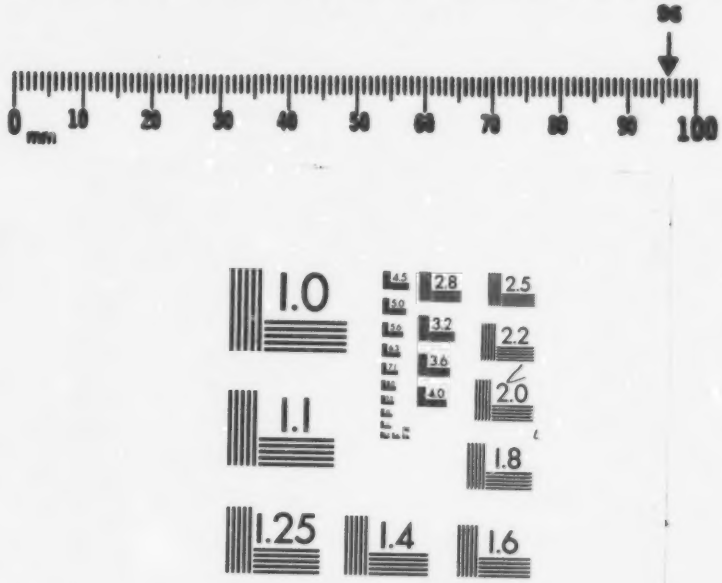

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A Fisheries Inventory of Apisko, Shallow, Kagipo, Assapan, Gilchrist, Whiskeyjack and Hallen Lakes, 1980.

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A Fisheries Inventory of Apisko, Shallow, Kagipo, Assapan, Gilchrist, Whiskeyjack and Hallen lakes, 1980.

Manitoba Department of Natural Resources.
Fisheries MS Report No. 86-08.

ABSTRACT

These inventories were conducted between June 22 to July 31, 1979 and June 12 to July 3, 1980. The purpose was to determine the sport fish potential of the lakes, assess the impact of commercial development on the sport fish populations and to provide baseline data to permit development of an allocation and use strategy for the fisheries resource. Each of these lakes are mesotrophic, Precambrian Shield, headwater lakes and as such are fairly low in productive capacity. They are probably supporting the climax biomass of fish of which they are capable.

The outcamp harvest on Apisko and Assapan has not yet affected the sport fish stocks in these lakes. However, the size of the outcamps should remain at their present licence capacity to ensure healthy fish stocks and a viable operation.

Shallow Lake appears to be an important forage and nursery area for fish stocks in that area of the Assapan River. It should remain primarily as such and as a wild rice lake.

Kagipo, Gilchrist, Whiskeyjack and Hallen lakes offer little or no sport fish potential and should remain remote wilderness lakes.

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INTRODUCTION

The inventories of these lakes were conducted at the following times:

Apisko	July 29 to 31, 1979 and July 3, 1980
Shallow	July 28 to 31, 1979
Kagipo	June 22 to 25, 1979
Assapan	June 28 to 30, 1980
Gilchrist	June 12 to 15, 1980
Whiskeyjack	June 17 to 18, 1980
Hallen	June 19 to 20, 1980

The objectives of these inventories were to determine the sport fish potential of the lakes, assess the impact of commercial development on the sport fish populations and to provide baseline data to permit development of an allocation and use strategy for the fisheries resources.

Each of these lakes are remote fly-in lakes. Apisko and Assapan lakes have been commercially developed as outcamp lakes, each with a capacity of 8 beds. The results of two angler surveys, 1972 and 1981, showed an increase of 48,625 angler days were spent in the East central portion of Manitoba. Most of the angler days were exerted by guests of lodges and their outcamps in the East Central area. Shallow Lake has been developed as a wild rice lake. There has been no commercial development on the other lakes, Kagipo, Gilchrist, Whiskeyjack and Hallen.

The Study Area

Each of the lakes is located approximately 310 km northeast of Winnipeg. Their exact locations by latitude (N) and longitude (W) are as follows:

Apisko	53°32'N 95°25'W
Shallow	52°34'N 95°29'W
Assapan	52°26'N 95°11'W
Kagipo	52°36'N 95°18'W
Gilchrist	52°51'N 95°52'W
Whiskeyjack	52°42'N 95°58'W
Hallen	52°43'N 95°55'W

The drainage basin area for each lake is summarized in Table 1.

The geology of the area is Precambrian, Paleozoic and Mesozoic bedrock of various lithologies and the topography is rolling to hilly in nature (Weir 1983). A more detailed description of the geology and soil composition of the area may be obtained from Dutchak *et. al.* (1978).

The natural vegetation of the area is northern coniferous forest consisting mainly of black spruce (*Picea mariana*), white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*). There is jackpine (*Pinus banksiana*) in recent burns with white birch (*Betula papyrifera*) and balsam poplar (*Populus balsamfera*) (Weir 1983).

Table 1. Drainage divisions and watershed units of Manitoba that contain the inventoried lakes.

Principal Drainage Division			Major Drainage Division			Watershed Division			Lake
No.	Name	Approx. area in Manitoba in km^2	No.	Name	Approx. area in Manitoba in km^2	No.	Name	Approx. area in Manitoba in km^2	
5	Nelson River	313,131	5RE	Poplar River Division	9705	5RE-M	Assapan River	520	Assapan
						5RE-M	Assapan River	520	Shallow
						5RE-M	Assapan River	520	Apisko
						5RE-N	Meandrine River	142	Kagipo
						5RE-G	Gilchrist Creek	598	Gilchrist
						5RE-F	McPhail Creek	634	Whiskeyjack
						5RE-F	McPhail Creek	634	Hallen

from Fedoruk (1970)

A detailed mapping of the vegetation surrounding each lake may be obtained from the Forest Inventory section of the Department of Natural Resources.

METHODS

Morphometry

The depth sounding in this survey was done with a Furuno FG200 MK3 unit with a range of 0 to 87 meters. Sounding transects were drawn in the field on photo base mosiacs of the inventoried lakes. The completed bathymetric maps were used to determine lake area, volume, mean depth and shoreline development according to procedures described by Hutchinson (1957).

Physical and Chemical Parameters

Field measurements of water temperature, dissolved oxygen, conductivity, pH and transparency were taken. The water temperature and dissolved oxygen profiles were recorded at one meter intervals from the surface to the bottom with a YSI electronic instrument. The specific conductivity was measured at the surface with a YSI electronic instrument. The pH was measured with a Hach wide range colour comparator field kit. The transparency was measured with a standard limnological Secchi disc according to Welch (1948).

Water samples for chemical analysis were taken from two

locations at each lake. Two one liter and one 500 ml samples were collected from each location. The 500 ml sample was fixed with 2.5 ml nitric acid (50%). The samples were submitted for analysis within 24 hours of being collected. Water samples were analysed by the Environmental Management Division of the Department of Environment and Workplace Safety and Health.

Fish

Small fish specimens (forage fish) were collected by seining a suitable area with a 1.2m by 7.4m seine of 6mm oval mesh. These were supplemented with samples taken with the fish toxicant, rotenone.

The sport species, i.e. walleye (Stizostedion vitreum) and northern pike (Esox lucius) were captured with standard gang gillnets. Each standard gang consisted of six gillnets with the mesh sizes in the following order: 3.8cm, 9.5cm, 5.1cm, 10.8cm, 7.6cm and 12.7cm. Each gillnet was 22.9m long and 1.8m deep. Gangs were set overnight for approximately 16 hours. The standard gang net sets were rotated around the lake to sample as many different habitat types as possible.

Walleye and northern pike were sampled for fork length, weight, sex, maturity and stomach contents. All other species were sampled for fork length and weight only. For age determination, otoliths and the first two dorsal spines were taken from walleye. From pike, cleithra and the first two pelvic rays were taken for

ageing. Otoliths were prepared and aged according to the procedures described by Erickson (1979). Cleithra were cleaned of skin and aged using an illuminated magnifying glass. The fin rays were not aged at this time.

Calculations

Procedures described by Snedecor and Cochran (1967) were followed for statistical analyses. The morphoedaphic index (MEI) was calculated according to Ryder's (1965) formula for moderately to intensively fished lakes. The trophic state of each lake was determined using the trophic state index (TSI) described by Carlson (1977).

The mean weighted age at onset of sexual maturity (Z) was calculated by the equation:

$$Z = \frac{A_1K_1+(A_2(K_2-K_1)+ A_3(K_3-K_2) + \dots A_n(K_n-K_{n-1})}{K_1+(K_2-K_1) + (K_3-K_2) + \dots (K_n-K_{n-1})}$$

where A = age (years)

K = % of mature fish in the nth age class.

This is a corrected form of Abrasov's (1967) original formula.

RESULTS

Morphometry

The shorelines of the inventoried lakes were quite diverse with shoreline development indicies ranging from 2.7 on Whiskeyjack to 7.8 on Apisko (Table 2). Bathymetric maps of the lakes are presented in Figs. 1 to 7. All depth contours are in meters.

Physical and Chemical Parameters

The Secchi disc transparencies (m) for each lake were as follows:

Apisko	1.0	July 28, 1979
Shallow	1.0	August 1, 1979
Kagipo	1.8	June 25, 1980
Assapan	1.7	June 30, 1980
Gilchrist	1.0	June 12, 1980
Whiskeyjack	1.0	June 20, 1980
Hallen	1.0	June 19, 1980

Temperature and dissolved oxygen profiles of the lakes (Figs. 8 and 9) showed all of them to be isothermal with near saturated levels of dissolved oxygen. The locations of sampling stations are illustrated in Figs. 10 to 16.

The average values for field measurements of pH and specific conductivity were fairly close to the values obtained from the lab analysis of the water samples (Table 3).

Table 2. Morphometric data for the inventoried lakes.

Parameter	Lake						
	Apisko	Shallow	Kagipo	Assapan	Gilchrist	Whiskeyjack	Hallen
Area (ha)	1382	870	342	404	1008	355	321
Maximum depth (m)	7.0	1.0	8.0	9.0	6.0	3.0	3.0
Mean depth (m)	1.7	0.5	3.1	4.6	1.4	1.4	1.8
Volume ($m^3 \times 10^6$)	23.188	4.317	10.518	18.714	14.051	5.073	5.713
Length of shoreline	102.5	37.5	33.2	43.8	34.2	18.1	24.9
Shoreline development index	7.8	3.6	5.1	6.2	3.0	2.7	3.9

Fig. 1. Bathymetric map of Apisko Lake.

SHALLOW LAKE

1:18 000

SCALE 0 500 1000 METRES

CONTOURS IN METRES

Fig. 2. Bathymetric

p of Shallow Lake.

Fig. 3. Bathymetric map of Kagipo Lake.

Produced by Surveys and Mapping Branch from information supplied by Fisheries Branch Manitoba

Fig. 4 Bathymetric

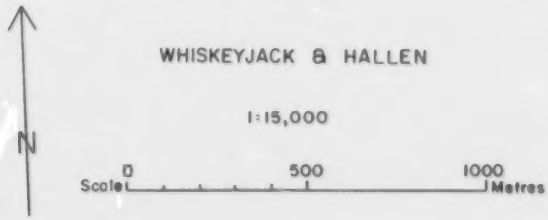
ap of Assapan Lake.

Produced by Surveys and Mapping Branch from information supplied by Fisheries Branch Manitoba 1973

Fig. 5. Bathymetric map of Gilchrist Lake.

Fig. 6. Bathymetric map of Whiskeyjack Lake.

Fig. 7. Bathymetric map of Hallen Lake.



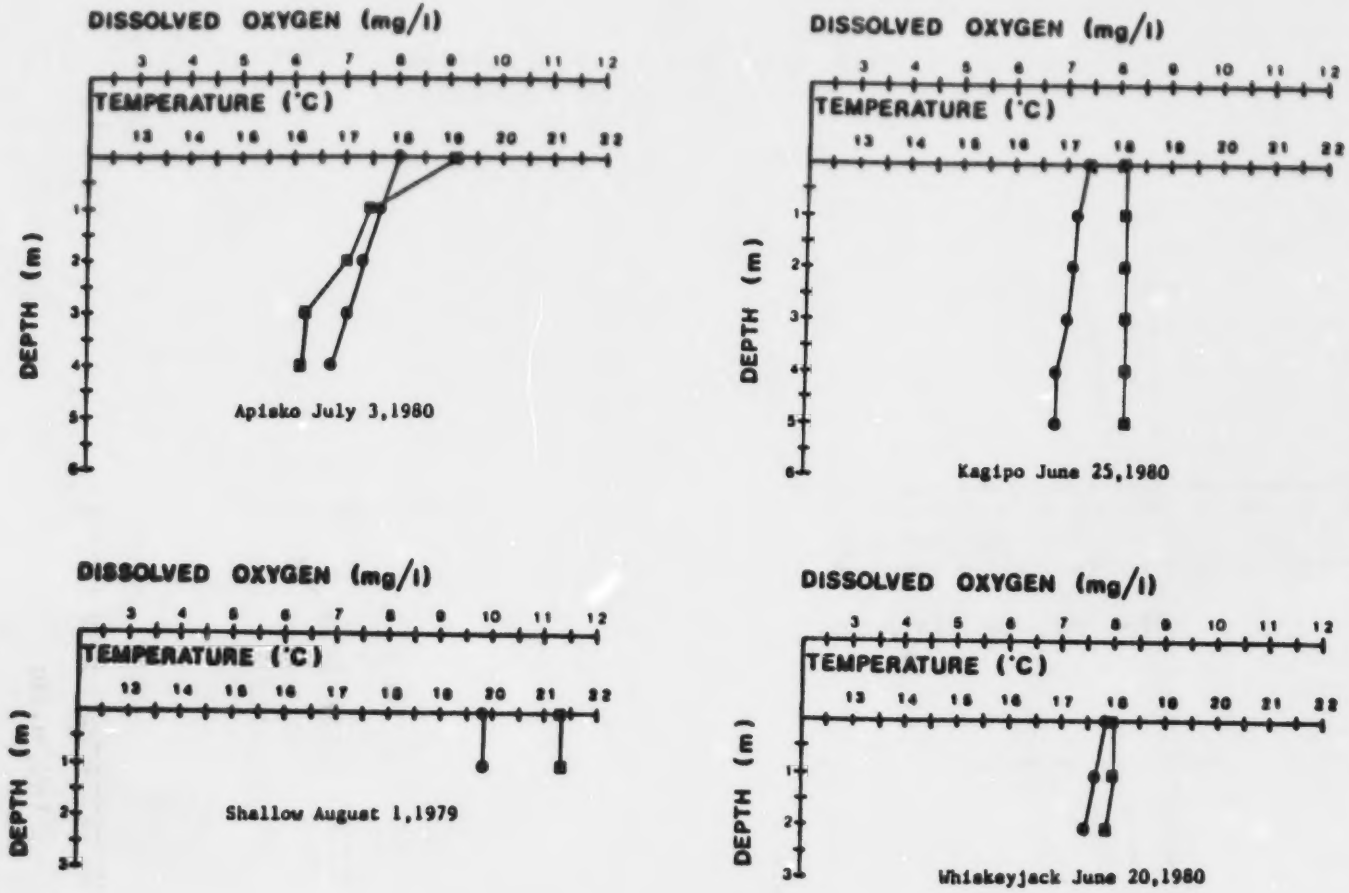


Fig. 8. Temperature ■ dissolved oxygen ● profiles of Apisko, Shallow, Kagipo and Whiskeyjack lakes.

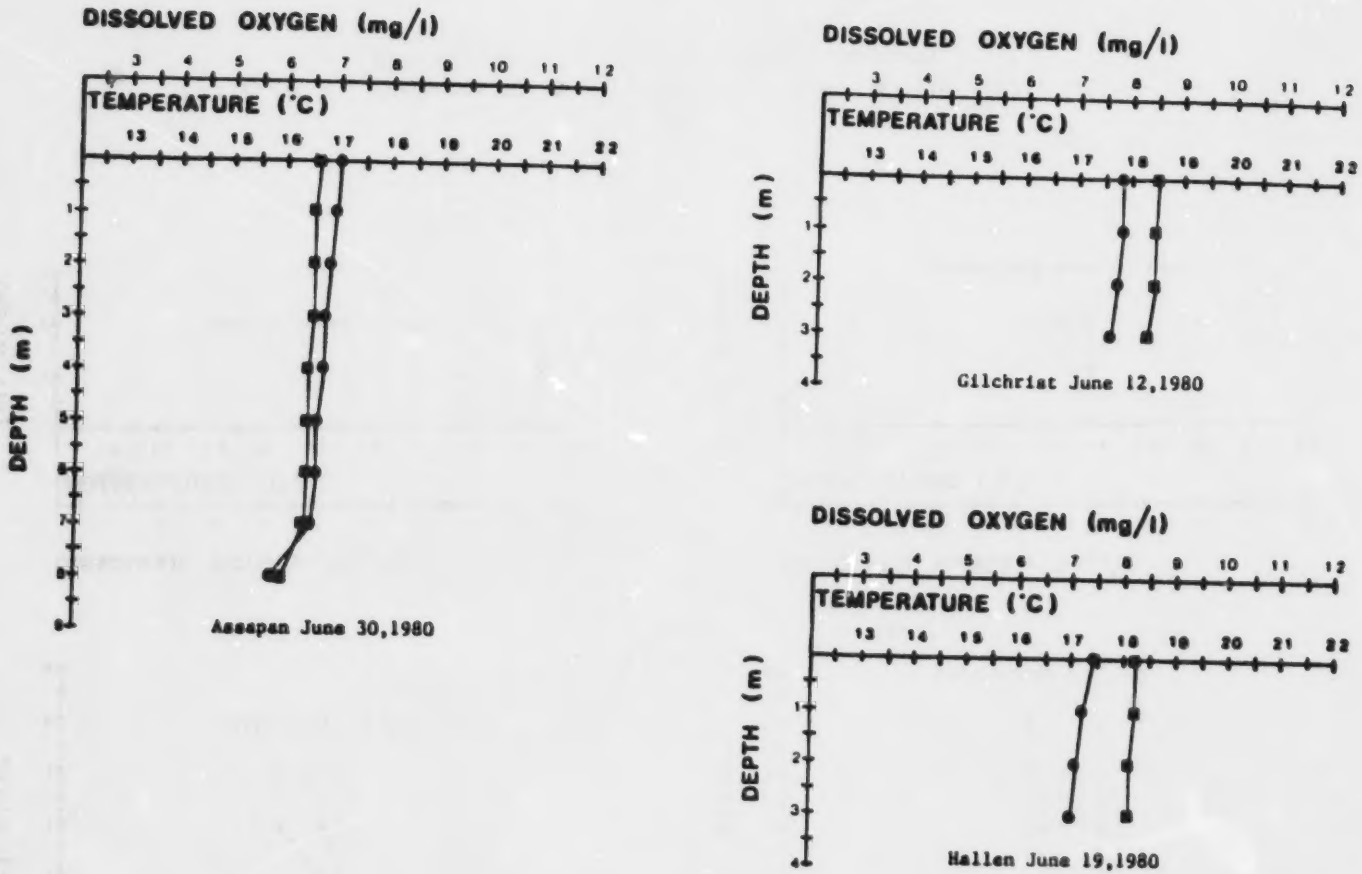


Fig. 9. Temperature ■ dissolved oxygen ● profiles of Assapan, Gilchrist and Hallen lakes.

Table 3. Water chemistry analysis of the inventory lakes.

Parameter	Apisko 250779			Shallow 250779			Assapan 260680			Kagipo 260680			Gilchrist 260680			Whiskeyjack 260680	Hallen 260680
	A1	A2	Mean	A1	A2	Mean	A1	A2	Mean	A1	A2	Mean	A1	A2	Mean	A1	A1
Conductivity (Field) (μmho cm^{-1})	27.0	28.0	27.5	23.0	22.0	22.5	21.0	23.0	22.0	20.0	20.0	20.0	20.0	20.0	20.0	24.0	22.0
Conductivity (Lab) (μmho cm^{-1})	31.2	29.9	30.5	26.4	22.9	24.6	22.0	23.0	22.5	24.6	24.9	24.7	26.5	26.1	26.3	31.1	27.7
Total dissolved solids (mg.ℓ^{-1})	42.0	50.0	46.0	52.0	50.0	51.0	58.0	46.0	52.0	49.0	56.0	52.2	45.0	41.0	43.0	64.0	52.0
Total suspended solids (mg.ℓ^{-1})	5.0	6.0	5.5	5.0	5.0	<5.0	<5.0	<5.0	5.0	5.0	5.0	5.0	11.0	11.0	11.0	8.0	<5.0
pH (Field)	7.1	7.1	7.1	6.9	6.9	6.9	6.35	6.35	6.35	6.60	6.60	6.60	7.0	7.0	7.0	6.80	6.70
pH (Lab)	6.85	7.0	6.9	6.75	6.9	6.8	6.45	6.50	6.47	6.60	6.70	6.65	6.80	6.90	6.85	6.85	6.70
Alkalinity Total ($CaCO_3$) (mg.ℓ^{-1})	10.0	14.0	12.0	10.0	10.0	10.0	8.0	8.0	8.0	8.0	10.0	9.0	12.0	12.0	12.0	12.0	12.0
Hardness ($CaCO_3$) (mg.ℓ^{-1})	<33.0	<33.0	<33.0	<33.0	<33.0	<33.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	16.0	16.0	16.0	<16.0	<16.0
Calcium - extractable (mg.ℓ^{-1})	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium - extractable (mg.ℓ^{-1})	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Potassium - extractable (mg.ℓ^{-1})	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium - extractable (mg.ℓ^{-1})	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Total organic carbon (mg.ℓ^{-1})	25.5	21.0	23.3	29.5	29.0	29.25	17.0	17.5	17.25	15.0	13.5	14.25	19.0	19.5	19.25	20.0	20.0
Total inorganic carbon (mg.ℓ^{-1})	4.0	2.0	3.0	4.0	2.0	3.0	1.0	1.5	1.25	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0
Colour	40.0	40.0	40.0	50.0	50.0	50.0	50.0	4.0	45.0	35	20	27.25	10	10	10	50	>50
Turbidity (NTU)	2.5	2.5	2.5	2.5	2.0	2.25	1.5	1.5	1.5	3.5	1.5	2.5	3.5	3.0	3.25	3.5	2.0
NO_3-NO_2-N dissolved (mg.ℓ^{-1})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus total (mg.ℓ^{-1})	0.03	0.03	0.025	0.03	0.02	0.025	0.02	0.02	0.02	0.02	0.01	0.01	0.03	0.02	0.02	0.04	0.03
Chlorine soluble (mg.ℓ^{-1})	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0
Sulfate soluble (mg.ℓ^{-1})	8.0	8.0	8.0	8.0	8.0	8.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7.0

The dissolved minerals in these lakes were dominated by bicarbonates (Table 3). Total dissolved solids ranged from 43.0 $mg.l^{-1}$ in Gilchrist to 64 $mg.l^{-1}$ in Whiskeyjack. Nutrient concentrations were quite low in these lakes. Total dissolved nitrogen, nitrites and nitrates were <0.01 $mg.l^{-1}$ in each lake. Total phosphorus was a little higher with a range of 0.01 $mg.l^{-1}$ in Kagipo to 0.04 $mg.l^{-1}$ in Whiskeyjack (Table 3).

Fish

There were fifteen species of small fish collected from these inventory lakes. The most abundant species generally were yellow perch (*Perca flavescens*) and spottail shiners (*Notropis hudsonius*). A summary of the species captured is given in Table 4. The sampling locations are shown in Figs. 10 to 16.

The standard gang net sets produced six species of fish, the most abundant being walleye. The standard gang catches are summarized in terms of numbers and total weight per mesh size in Tables 5 to 11. The locations of the standard gang sets are illustrated in Figs. 10 to 16. Catch summaries for each net set for each lake are given in Appendices 1 to 7.

Walleye Age and Growth

The age-specific mean fork lengths, weights and condition factors for walleye from these lakes are presented in Tables 12, 13 and 14. The small sample size of walleye in most cases may not permit an accurate representation of age-frequency distributions

Table 4. Small fish collected from the inventory lakes.

Species	Number of Fish						
	Apisko	Shallow	Assapan	Kagipo	Gilchrist	Whiskeyjack	Hallen
Walleye (*Stizostedion vitreum*)	11	6	-	1	-	-	-
Yellow perch (*Perca flavescens*)	99	10	28	150	180	-	1
Spottail shiner (*Notropis hudsonius*)	82	22	11	175	-	101	1
White sucker (*Catostomus commersoni*)	1	13	-	-	3	-	-
Johnny darter (*Etheostoma nigrum*)	62	63	5	16	-	182	90
Iowa darter (*Etheostoma exile*)	2	-	-	1	-	-	-
Blackside darter (*Percina maculata*)	5	-	-	-	-	-	-
Emerald shiner (*Notropis atherinoides*)	12	2	15	-	-	-	-
Northern pike (*Esox lucius*)	2	4	-	4	1	2	-
Burbot (*Lota lota*)	5	7	-	5	-	10	4
Trout perch (*Percopsis omiscomaycus*)	-	6	-	-	-	-	-
Central mudminnow (*Umbra limi*)	-	-	-	-	5	-	-
Blacknose shiner (*Notropis heterolepis*)	-	-	1	12	-	-	-
Slimy sculpin (*Cottus cognatus*)	-	-	-	13	-	37	1
River darter (*Percina shumardi*)	-	-	-	-	-	30	-

Table 5. Gillnet summary Apisko Lake.

Species		Mesh size (cm) 3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Northern pike (*Esox lucius*)	No.	6	9	10	4	1	-	30	6.1
	kg.	52	9.9	11.7	11.7	2.3		40.8	12.3
Walleye (*Stizostedion vitreum*)	No.	20	43	92	35	5	-	195	39.9
	kg.	7.3	19.1	44.7	22.3	4.2		97.6	29.4
Yellow perch (*Perca flavescens*)	No.	8	6	2	3	-	-	19	3.9
	kg.	0.8	1.0	1.1	0.4			3.2	1.2
White sucker (*Catostomus commersoni*)	No.	1	2	12	18	22	5	60	12.3
	kg.	1.0	0.8	13.1	18.9	26.3	8.4	68.5	20.5
Whitefish (*Coregonus clupeaformis*)	No.	-	-	1	-	-	2	3	0.6
	kg.			2.8			4.5	7.3	2.2
Cisco (*Coregonus artedii*)	No.	10	29	32	35	40	36	182	37.2
	kg.	2.2	10.2	21.0	24.2	28.9	27.8	114.3	34.4
Total	No.	45	89	149	95	68	43	489	
	kg.	16.5	41.0	94.4	77.5	61.7	40.7	331.8	
Mean no. of pike/mesh		0.8	1.1	1.2	0.5	0.1	-	3.7	
Mean no. of walleye/mesh		2.5	5.4	11.5	4.4	0.6	-	24.4	
Mean no. of fish/mesh		5.6	11.1	18.6	11.9	8.5	5.4	61.1	
Mean biomass/mesh (units)		2.1	5.1	11.8	9.7	7.7	5.1	41.5	

Total effort of each mesh was 184m (8 sets x 23m)

Table 6. Gillnet summary Shallow Lake.

Species		Mesh size (cm) 3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Northern pike (*Esox lucius*)	No.	6	5	7	2	2	2	24	9.3
	kg.	4.1	7.1	15.9	8.1	6.4	6.3	47.9	35.8
Walleye (*Stizostedion vitreum*)	No.	23	32	31	14	5	-	105	40.7
	kg.	6.2	11.2	15.1	8.0	3.1	-	43.6	32.7
White sucker (*Cotostomus commersoni*)	No.	1	-	8	9	9	2	29	11.2
	kg.	0.05	-	4.7	7.5	11.1	2.9	26.25	19.6
Yellow perch (*Perca flavescens*)	No.	44	33	11	-	-	-	88	34.1
	kg.	2.8	5.1	2.7	-	-	-	10.6	7.9
Whitefish (*Coregonus clupeaformis*)	No.	-	-	1	-	-	2	3	1.2
	kg.	-	-	0.3	-	-	3.1	3.4	2.5
Cisco (*Coregonus artedii*)	No.	5	1	1	1	-	1	9	3.5
	kg.	0.2	0.04	0.4	0.7	-	0.7	2.04	1.5
Total	No.	79	71	59	26	16	7	258	
	kg.	13.35	23.44	39.1	24.3	20.6	13.0	133.79	
Mean no. of pike/mesh		0.2	1.2	1.7	0.5	0.5	0.5	4.6	
Mean no. of walleye/mesh		5.8	8.0	7.8	3.5	1.2	-	26.3	
Mean no. of fish/mesh		19.8	17.8	14.8	6.5	4.0	1.8	64.7	
Mean biomass/mesh (units)		3.3	5.9	9.8	6.1	5.2	3.2	33.5	

Total effort of each mesh was 92m (4 sets x 23m)

Table 7. Gillnet summary Assapan Lake.

Species		Mesh size (cm) 3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Northern pike (*Esox lucius*)	No.	8	3	9	5	-	-	25	10.5
	kg.	8.4	3.1	10.6	8.8	-	-	30.9	27.9
Walleye (*Stizostedion vitreum*)	No.	11	10	18	13	11	3	66	27.7
	kg.	5.3	7.2	12.6	12.7	12.4	6.9	57.1	51.5
Yellow perch (*Perca flavescens*)	No.	8	6	-	-	-	-	14	5.9
	kg.	0.5	0.9	-	-	-	-	1.4	1.3
White sucker (*Catostomus commersoni*)	No.	-	1	-	1	3	1	6	2.5
	kg.	-	0.1	-	1.2	4.3	1.9	7.5	6.8
Cisco (*Coregonus artedii*)	No.	65	58	4	-	-	-	127	53.4
	kg.	4.1	8.9	0.9	-	-	-	13.9	12.5
Total	No.	92	78	31	19	14	4	238	
	kg.	18.3	20.2	24.1	22.7	16.7	8.8	110.8	
Mean no. of pike/mesh		1.3	0.5	1.5	0.8	-	-	4.1	
Mean no. of walleye/mesh		1.8	1.7	3.0	2.2	1.8	0.5	11.0	
Mean no. of fish/mesh		15.3	13.0	5.2	3.2	2.3	0.7	39.7	
Mean biomass/mesh		3.0	3.2	4.0	3.8	2.8	1.5	18.3	

Total effort of each mesh was 138m (6 sets x 23m)

Table 8. Gillnet summary Kagipo Lake.

Species		Mesh size (cm)							
		38.1	5.08	7.62	9.52	10.79	12.70	Total	%
Northern pike (*Esox lucius*)	No.	5	3	-	5	1	2	16	13.7
	kg.	5.6	5.1	-	10.0	2.3	6.6	29.6	44.6
Walleye (*Stizostedion vitreum*)	No.	19	5	3	6	3	1	37	31.6
	kg.	4.4	5.0	1.4	4.1	2.9	1.5	19.3	29.1
Yellow perch (*Perca flavescens*)	No.	2	-	-	-	-	-	2	1.7
	kg.	0.1	-	-	-	-	-	0.1	0.1
Whitefish (*Corgeonus clupeaformis*)	No.	-	1	-	-	-	2	3	2.3
	kg.	-	1.2	-	-	-	2.5	3.7	5.6
White sucker (*Catostomus commersoni*)	No.	-	-	-	-	3	2	5	4.3
	kg.	-	-	-	-	2.9	3.1	6.0	9.0
Cisco (*Coregonus artedii*)	No.	34	11	6	-	3	-	54	46.2
	kg.	2.6	1.4	2.4	-	1.3	-	7.7	11.6
Total	No.	60	20	9	11	10	7	117	
	kg.	12.7	12.7	3.8	14.1	9.4	13.7	66.4	
Mean no. of pike/mesh		0.8	0.5	-	0.8	0.2	0.3	2.6	
Mean no. of walleye/mesh		3.2	0.8	0.5	1.0	0.5	0.2	6.2	
Mean no. of fish/mesh		10.0	3.3	1.5	1.8	1.7	1.2	19.5	
Mean biomass/mesh		2.1	2.1	0.6	2.4	1.5	2.3	11.0	

Total effort of each mesh was 138m (6 sets x 23m)

Table 9. Gillnet summary Gilchrist Lake.

Species		Mesh size (cm)							
		3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Northern pike (*Esox lucius*)	No.	5	12	30	26	16	4	93	61.6
	kg.	7.5	22.4	45.8	59.0	35.1	10.6	180.4	77.1
Yellow perch (*Perca flavescens*)	No.	7	-	-	-	-	-	7	4.6
	kg.	0.3	-	-	-	-	-	0.3	0.1
White sucker (*Catastomus commersoni*)	No.	1	11	8	11	16	4	51	33.8
	kg.	0.8	11.7	5.5	12.2	16.9	6.3	53.4	22.8
Total	No.	13	23	38	37	32	8	151	
	kg.	8.6	34.1	51.3	71.2	52.0	16.9	234.1	
Mean no. pike/mesh		0.8	2.0	5.0	4.3	2.7	0.7	15.5	
Mean no. fish/mesh		2.2	3.8	6.3	6.2	5.3	1.3	25.2	
Mean biomass/mesh		1.4	5.7	8.5	11.9	8.7	2.8	39.0	

Total effort of each mesh was 138m (6 sets x 23m).

Table 10. Gillnet summary Whiskeyjack Lake.

Species		Mesh size (cm)							
		3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Northern pike (*Esox lucius*)	No.	1	5	4	2	1	-	13	21.3
	kg.	7.7	6.9	12.9	2.8	1.1	-	31.4	56.3
Walleye (*Stizostedion vitreum*)	No.	3	13	10	9	1	-	36	59.0
	kg.	0.8	3.2	5.5	6.0	1.1	-	16.6	29.7
Yellow perch (*Perca flavescens*)	No.	-	5	-	-	-	-	5	8.2
	kg.	-	0.2	-	-	-	-	0.2	0.3
White sucker (*Catostomus commersoni*)	No.	-	2	-	1	4	-	7	11.5
	kg.	-	0.9	-	2.1	4.7	-	7.7	13.8
Total	No.	4	25	14	12	6	-	61	
	kg.	8.5	11.2	18.4	10.9	6.9	-	55.9	
Mean no. of pike/mesh		0.3	1.7	1.3	0.7	0.3	-	4.3	
Mean no. of walleye/mesh		1.0	4.3	3.3	3.0	0.3	-	11.9	
Mean no. of fish/mesh		1.3	8.3	4.7	4.0	2.0	-	20.3	
Mean biomass/mesh		2.8	3.7	6.1	3.6	2.3	-	18.5	

Total effort of each mesh was 69m (3 sets x 23m)

Table 11. Gillnet summary Hallen Lake.

Species		Mesh size (cm)							
		3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Northern pike (*Esox lucius*)	No.	2	4	4	1	-	1	12	27.3
	kg.	5.0	6.8	8.6	3.1	-	7.0	30.5	75.3
Walleye (*Stizostdion vitreum*)	No.	5	15	4	1	-	1	26	59.1
	kg.	1.2	3.9	1.5	0.1	-	0.2	6.9	17.1
Yellow perch (*Perca flavescens*)	No.	-	1	-	-	-	-	1	2.3
	kg.	-	0.1	-	-	-	-	0.1	0.2
White sucker (*Catostomus commersoni*)	No.	-	3	1	1	-	-	5	11.3
	kg.	-	1.4	0.7	0.9	-	-	3.0	7.4
Total	No.	7	23	9	3	-	2	44	
	kg.	6.2	12.2	10.8	4.1	-	7.2	40.5	
Mean no. pike/mesh		0.7	1.3	1.3	0.3	-	0.3	3.9	
Mean no. walleye/mesh		1.7	5.0	1.3	0.3	-	0.3	8.6	
Mean no. fish/mesh		2.3	7.7	3.0	1.0	-	0.7	14.7	
Mean biomass/mesh		2.1	4.1	3.6	1.4	-	2.4	13.6	

Total effort of each mesh was 69m (3 sets x 23m)

Fig. 10. Locations of chemical stations and fish collection sites in Apsko Lake.

SHALLOW LAKE

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CONTOURS IN METRES

Fig. 11. Locations of ch
sites in Shallo

f chemical stations and fish collection
allow Lake.

Produced by: Surveys and Mapping Branch from information supplied by Fisheries Branch, Manitoba, 1979.

Fig. 12. Locations of chemical stations and fish collection sites in Kagipo Lake.

Produced by Surveys and Mapping Branch from information supplied by Fisheries Branch, Manitoba

Fig. 13. Locations of chemic
sites in Assapan La

stations and fish collection

Prepared by Surveys and Mapping Branch from information supplied by Fisheries Branch Manitoba 1978

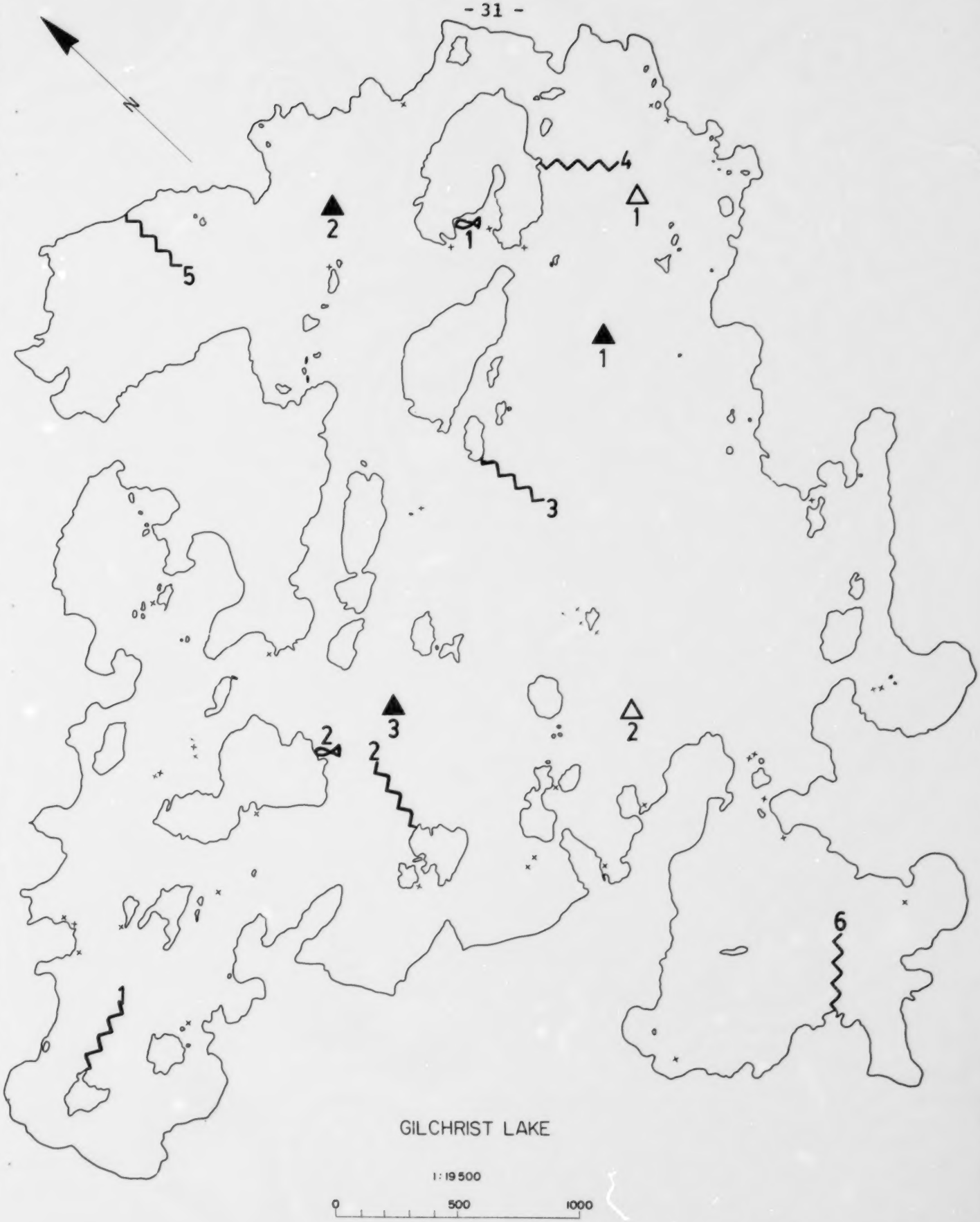

Fig. 14. Locations of chemical stations and fish collection sites in Gilchrist Lake.

Produced by: Surveys and Mapping Branch from information supplied by Fisheries Branch, Manitoba, 1979.

Fig. 16. Locations of chemical stations and fish collection sites in Hallen Lake.

Fig. 15. Locations of chemical stations and fish collection sites in Whiskeyjack Lake.

Table 12. Age-specific mean fork lengths, weights and condition factors for walleye from Apisko and Shallow lakes.

	Apisko					Shallow				
Age (yrs)	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor
1	-	-	-	-	-	1	0.95	140.00	20.00	0.73
2	1	0.52	170.00	60.00	1.22	2	1.90	196.00	70.00	0.93
3	2	1.04	215.00	115.00	1.16	3	2.86	239.33	140.00	1.01
4	1	0.52	300.00	280.00	1.04	8	7.62	243.50	144.38	0.91
5	6	3.13	279.67	240.00	1.05	9	8.57	286.22	238.89	1.03
6	18	9.38	312.22	326.11	1.07	5	4.76	302.80	282.00	1.02
7	5	2.60	330.00	376.00	1.04	8	7.62	315.75	335.00	1.06
8	35	18.23	346.11	433.71	1.04	6	5.71	345.00	416.67	1.01
9	29	15.10	345.93	442.76	1.05	28	26.67	353.86	456.43	1.02
10	17	8.85	378.24	589.41	1.07	3	2.86	350.00	446.67	1.04
11	2	1.04	339.00	370.00	0.95	1	0.95	332.00	440.00	1.20
12	4	2.08	386.00	612.50	1.06	6	5.71	382.00	565.00	1.00
13	11	5.73	391.45	658.18	1.06	6	5.71	356.00	495.00	1.09
14	2	1.04	397.00	640.00	1.03	4	3.81	394.50	650.00	1.05
15	10	5.21	386.20	618.00	1.06	2	1.90	377.00	540.00	1.00
16	12	6.25	370.67	525.00	1.02	4	3.81	405.50	635.00	0.94
17	11	5.73	396.55	635.45	1.01	2	1.90	420.00	700.00	0.95
18	11	5.73	388.00	598.18	1.02	1	0.95	386.00	560.00	0.97
19	5	2.60	384.00	638.00	1.11	4	3.81	402.50	675.00	1.02
20	6	3.13	405.67	686.67	1.02	2	1.90	397.00	640.00	1.02
21	2	1.04	445.00	880.00	1.00	-	-	-	-	-
22	1	0.52	360.00	520.00	1.11	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-
24	1	0.52	426.00	740.00	0.96	-	-	-	-	-
Total	192					105				
Mean			357.90	499.43	1.05			335.10	414.81	1.01

Table 13. Age-specific mean fork lengths, weights and condition factors for walleye from Kagipo and Assapan lakes.

	Kagipo					Assapan				
Age (yrs)	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor
1	-	-	-	-	-	1	1.56	164.00	50.00	1.13
2	2	5.41	160.00	50.00	1.22	-	-	-	-	-
3	7	18.92	184.29	62.14	0.98	-	-	-	-	-
4	4	10.81	207.00	98.75	1.08	3	4.69	242.00	146.67	1.03
5	5	13.51	264.00	190.00	1.02	3	4.69	286.67	266.67	1.13
6	2	5.41	292.00	320.00	1.32	1	1.56	374.00	620.00	1.19
7	1	2.70	308.00	280.00	0.96	2	3.13	330.00	380.00	1.02
8	2	5.41	327.00	330.00	0.95	1	1.56	364.00	540.00	1.12
9	2	5.41	356.00	465.00	1.03	2	3.13	368.00	540.00	1.09
10	3	8.11	382.00	600.00	1.08	13	20.31	438.15	921.54	1.08
11	-	-	-	-	-	1	1.56	400.00	700.00	1.09
12	-	-	-	-	-	1	1.56	492.00	1200.00	1.01
13	2	5.41	440.00	1005.00	1.16	5	7.81	416.00	840.00	1.11
14	3	8.11	508.67	1533.33	1.06	11	17.19	429.27	830.91	1.02
15	2	5.41	467.00	1110.00	1.05	4	6.25	420.50	820.00	1.06
16	-	-	-	-	-	3	4.69	440.00	866.67	0.98
17	-	-	-	-	-	4	6.25	470.00	1180.00	1.07
18	-	-	-	-	-	1	1.56	484.00	1240.00	1.09
19	-	-	-	-	-	5	7.81	464.40	1072.00	1.02
20	1	2.70	602.00	2360.00	1.08	2	3.13	541.00	2120.00	1.15
21	-	-	-	-	-	-	-	-	-	-
22	1	2.70	552.00	1900.00	1.13	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	1	1.56	596.00	2540.00	1.20
Total	37					64				
Mean			315.03	521.08	1.06			416.25	867.03	1.06

Table 14. Age-specific mean fork lengths, weights and condition factors for walleye from Whiskeyjack and Hallen lakes.

	Whiskeyjack					Hallen				
Age (yrs)	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor
3	3	8.33	182.00	66.67	1.09	2	7.69	216.00	110.00	1.09
4	4	11.11	245.00	150.00	1.00	10	38.46	255.40	161.00	0.95
5	2	5.56	280.00	220.00	0.99	2	7.69	240.00	145.00	1.03
6	1	2.78	288.00	240.00	1.00	2	7.69	294.00	220.00	0.87
7	3	8.33	324.00	360.00	1.06	1	3.85	334.00	400.00	1.07
8	1	2.78	328.00	360.00	1.02	2	7.69	320.00	350.00	1.03
9	7	19.44	362.00	508.57	1.06	3	11.54	342.00	420.00	1.05
10	7	19.44	384.00	600.00	1.04	2	7.69	338.00	390.00	1.00
11	2	5.56	379.00	570.00	1.05	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-
13	1	2.78	372.00	580.00	1.13	-	-	-	-	-
14	1	2.78	420.00	880.00	1.19	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	1	3.85	364.00	460.00	0.95
17	-	-	-	-	-	1	3.85	424.00	860.00	1.13
18	1	2.78	364.00	520.00	1.08	-	-	-	-	-
19	2	5.56	441.00	920.00	1.06	-	-	-	-	-
20	1	2.78	436.00	1000.00	1.21	-	-	-	-	-
Total	36					26				
Mean			337.06	462.22	1.05			289.15	270.00	0.99

(Appendix 8 and 9), length-weight relationships (Appendix 10), exponential growth curves (Appendix 11), or maturity regimes of the walleye populations from these lakes (Appendix 12).

Northern Pike Age and Growth

Age-specific mean fork lengths, weights and condition factors for northern pike from the inventory lakes are presented in Tables 15 to 17. The small sample size of northern pike may not permit accurate representation of age-frequency distributions, length-weight relationships, exponential growth curves or maturity regimes from these lakes. The data for the above parameters are presented in Appendices 13 to 17.

Stomach Contents

An examination of the stomach contents of the walleye and northern pike from these lakes showed fish to be the most prevalent diet item. Of the identifiable remains spottail shiners were the most numerous (Table 18).

Production Potential

The morphoedaphic index (MEI) described by Ryder (1965) was used to provide an estimate of the maximum sustained yield (MSY) of these inventory lakes. The derived potential yields are given in Table 19. Since Kagipo and Assapan are the only lakes whose mean depth is greater than the minimum for accurate estimates of the MEI

Table 15. Age-specific mean fork lengths, weights and condition factors for northern pike from Apisko and Shallow lakes.

	Apisko					Shallow				
Age (yrs)	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor
1	1	3.33	222.00	80.00	0.73	1	4.17	190.00	40.00	0.58
2	4	13.33	361.00	305.00	0.65	2	8.33	316.50	170.00	0.53
3	2	6.67	449.00	520.00	0.58	3	12.50	330.67	226.67	0.62
4	3	10.00	481.33	626.67	0.56	4	16.67	418.00	430.00	0.59
5	5	16.67	489.60	700.00	0.60	2	8.33	464.00	535.00	0.53
6	5	16.67	592.40	1392.00	0.58	-	-	-	-	-
7	4	13.33	682.50	2315.00	0.66	2	8.33	822.00	3770.00	0.66
8	2	6.67	649.00	2100.00	0.71	4	16.67	735.50	2970.00	0.72
9	2	6.67	676.00	2280.00	0.64	3	12.50	855.33	4706.67	0.74
10	2	6.67	801.00	4060.00	0.75	1	4.17	840.00	3800.00	0.64
11	-	-	-	-	-	2	8.33	805.00	3410.00	0.63
Total	30					24				
Mean			546.67	1360.67	0.63			584.04	2000.42	0.63

Table 16. Age-specific mean fork lengths, weights and condition factors for northern pike from Whiskeyjack and Hallen lakes.

	Whiskeyjack					Hallen				
Age (yrs)	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor
2	1	7.69	246.00	120.00	0.81	-	-	-	-	-
3	-	-	-	-	-	1	8.33	370.00	320.00	0.63
4	-	-	-	-	-	1	8.33	404.00	440.00	0.67
5	1	7.69	552.00	1180.00	0.70	1	8.33	562.00	1120.00	0.63
6	3	23.08	549.33	1113.33	0.65	1	8.33	508.00	920.00	0.70
7	3	23.08	562.67	1213.33	0.67	1	8.33	704.00	2540.00	0.73
8	1	7.69	606.00	1360.00	0.61	3	25.00	713.33	2480.00	0.65
9	1	7.69	792.00	3740.00	0.75	-	-	-	-	-
10	1	7.69	750.00	2920.00	0.69	1	8.33	766.00	2980.00	0.66
11	-	-	-	-	-	3	25.00	872.67	4906.67	0.71
12	1	7.69	1020.00	7680.00	0.72	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-
14	1	7.69	1000.00	7500.00	0.75	-	-	-	-	-
Total	13					12				
Mean			638.62	2421.54	0.69			672.67	2540.00	0.68

Table 17. Age-specific mean fork lengths, weights and condition factors for northern pike from Gilchrist, Kagipo and Assapan lakes.

	Gilchrist					Kagipo					Assapan				
Age (yrs)	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor	Number	Frequency (%)	Mean Length (mm)	Mean Weight (g)	Mean Condition Factor
2	-	-	-	-	-	2	12.50	263.00	130.00	0.64	3	12.00	284.67	200.00	0.79
3	2	2.20	433.00	530.00	0.66	-	-	-	-	-	1	4.00	464.00	700.00	0.70
4	12	13.19	462.17	625.00	0.62	1	6.25	370.00	340.00	0.67	-	-	-	-	-
5	13	14.29	591.54	1342.31	0.63	2	12.50	458.00	640.00	0.65	4	16.00	470.00	710.00	0.69
6	26	28.57	662.54	1858.85	0.61	-	-	-	-	-	8	32.00	554.50	1240.00	0.71
7	24	26.37	723.17	2706.25	0.70	4	25.00	627.50	1485.00	0.60	4	16.00	667.00	1835.00	0.62
8	11	12.09	731.27	2678.18	0.65	4	25.00	684.00	2165.00	0.67	3	12.00	676.00	2066.67	0.65
9	1	1.10	868.00	5300.00	0.81	-	-	-	-	-	1	4.00	588.00	1260.00	0.62
10	2	2.20	778.00	3310.00	0.66	2	12.50	865.00	4970.00	0.77	1	4.00	666.00	2040.00	0.69
Total	91					15					25				
Mean			650.02	1985.38	0.65			598.00	1847.50	0.66			543.36	1236.00	0.69

Table 18. Stomach contents of walleye and northern pike from the inventoried lakes.

	Apisko		Shallow		Kagipo		Assapan		Gilchrist		Whiskeyjack		Hallen	
	Walleye	N. pike	Walleye	N. pike	Walleye	N. pike	Walleye	N. pike	Walleye	N. pike	Walleye	N. pike	Walleye	N. pike
	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Number examined	195	30	24	24	39	16	66	26	0	93	37	13	26	12
Empty	47.9	68.0	49.5	73.9	12.8	75.2	18.2	73.2		75.8	16.2	92.3	19.3	66.7
Fish														
Yellow perch	7.7		0.9	4.4						1.1				
Cisco		4.0					6.1	7.7						
Johnny darter			0.9											
Whitefish														
Spottail shiner		4.0			10.3	6.3	4.5				8.2		3.8	
White sucker				4.4				3.8		12.1				
Walleye				4.4		6.3								8.3
Northern pike										1.1				
Unidentified fish remains	42.0	8.0	16.5		33.3		48.5	7.7		9.9	37.8		3.8	25.0
Invertebrates														
Ephemeroptera			26.2	8.5	43.6		22.7	3.8			37.8		73.1	
Diptera			3.2											
Trichoptera	1.8		1.9											
Amphipoda														
Decapoda		16.0		4.4		6.3		3.8				7.7		
Hirundinea	0.6													
Unidentified invertebrate remains			0.9			6.3								

Table 19. MEI and estimated production potential (MSY) for the lakes inventoried.

Lake	Mean depth(m)	TDS $mg.l^{-1}$	MEI	Potential yield $kg.ha^{-1}.yr^{-1}$
Apisko	1.7	46.0	27.4	6.6
Shallow	0.5	51.0	102.8	12.4
Kagipo	3.1	52.2	16.9	5.3
Assapan	4.6	52.0	11.2	4.3
Gilchrist	1.4	43.0	30.9	7.0
Whiskeyjack	1.4	64.0	44.8	8.4
Hallen	1.8	52.0	29.2	6.8

Table 20. Trophic state indices of the inventoried lakes.

Lake	Secchi disc	TSI	Total Phosphorus mg/m^3	TSI
Apisko	1.0	60	25	50.6
Shallow	1.0	60	25	50.6
Assapan	1.7	52.3	20	47.4
Kagipo	1.8	51.5	10	37.4
Gilchrist	1.0	60	20	47.4
Whiskeyjack	1.0	60	40	57.4
Hallen	1.0	60	30	53.2

equation, the results should be interpreted with caution.

According to Adams and Olver (1977) the MEI for each of the lakes is in the eutrophic range. A more realistic determination of the trophic state of the lakes may be obtained using the trophic state index (TSI) described by Carlson 1977. Based on a TSI range of 0-100, the inventoried lakes would be considered mesotrophic (Table 20).

DISCUSSION

Morphometry

The morphometry of Shallow Lake restricts the useable fish habitat to the open water season. It is very likely the lake partially winterkills most years (max. depth 1.0 m). The flow through of the Assapan River would create some useable winter habitat. However, the main importance of Shallow Lake to the fish stocks of the area is as a feeding and nursery area.

Restricted winter habitat is likely a factor in limiting the fish populations of Whiskeyjack, Hallen and Gilchrist lakes. Sufficient depth of water under ice cover is available in only small areas of these lakes. Morphometry is probably not a limiting factor to fish populations in Apisko, Assapan and Kagipo lakes. All have adequate areas of deep water winter habitat.

Physical and Chemical Parameters

Temperature-dissolved oxygen levels in these lakes were isothermal and near saturated levels, posing no restriction on fish habiat. The ionic composition of these lakes was similar to other

Precambrian lakes on the east side of Lake Winnipeg (Hagenson and O'Connor 1980, 1981, Hagenson 1983).

Fish

The small sample size of walleye and northern pike collected from these lakes, in most cases, prevents an accurate representation of their growth or maturity regimes. However, the age-specific mean fork lengths and weights of the walleye and northern pike from these lakes was similar to the age-specific mean fork lengths and weights of walleye and northern pike from other lakes on the east side of Lake Winnipeg (Hagenson 1984; Hagenson 1983a, 1983b; Hagenson and O'Connor 1981, 1980, 1979.)

Comparing mean biomass per mesh from these lakes to other lakes on the east side of Lake Winnipeg (Table 21) shows they are similar to other lakes of comparable morphometry and species composition. These lakes also contain the basic, critical species components and associated species detailed by Ryder and Kerr (1978) for a harmonic percid community in a boreal forst zone, a characteristic of which is high community integrity resulting in stability of biomass.

An examination of the Master Angler Awards from 1972 to 1984 shows only Apisko to have produced any qualifying fish, 1 walleye and 13 northern pike. The minimum qualifying weight is 3.6 kg for walleye and 9.0 kg for northern pike.

Table 21. Mean biomass per mesh (kg) from lakes on the east side of Lake Winnipeg.

Lake	Mesh						
	3.81	5.08	11.8	9.52	10.79	12.70	Total
Apisko	2.1	5.1	11.8	9.7	7.7	5.1	41.5
Shallow	3.3	5.9	9.8	6.1	5.2	3.2	33.5
Kagipo	2.1	2.1	0.6	2.4	1.5	2.3	11.0
Assapan	3.0	3.2	4.0	3.8	2.8	1.5	18.3
Gilchrist	1.4	5.7	8.5	11.9	8.7	2.8	39.0
Whiskeyjack	2.8	3.7	6.1	3.6	2.3	-	18.5
Hallen	2.1	4.1	3.6	1.4	-	2.4	13.6
Sasaginnigak[1]	3.5	4.3	7.7	5.2	4.5	1.6	26.9
Charron[1]	0.8	1.2	4.4	3.8	1.8	3.4	14.1
Night Owl[2]	0.4	0.4	4.0	3.7	2.4	0.2	14.1
Horseshoe[2]	1.1	2.7	4.6	3.4	1.4	1.5	14.7
Long[2]	0.03	1.9	6.5	3.4	0.7	0.2	12.7
Morfee[3]	0.3	3.0	6.9	3.0	2.6	0.7	16.6
Ewart[3]	3.0	2.1	2.5	3.9	2.8	0.4	14.7
Carr-Harris[3]	1.7	1.8	3.2	1.9	3.8	0.4	12.8
Lynx[3]	1.2	2.5	8.5	4.1	3.9	3.1	23.3
Harrop[4]	1.8	6.3	12.2	8.7	4.5	1.9	35.4
Eardley[4]	2.2	4.5	9.7	5.7	4.6	1.6	28.3
Weaver[4]	3.7	7.3	16.8	11.4	10.5	3.4	53.0
Wrong[4]	1.8	6.3	15.9	9.7	9.8	5.3	48.9
Dogskin[5]	1.9	7.2	18.9	13.5	7.1	4.4	53.0
Family[5]	1.5	3.8	13.9	5.7	4.9	1.9	31.9
Viking[5]	2.8	4 8	9.1	7.7	5.0	1.8	31.3
Vickers[5]	9.0	1.2	6.8	4.4	2.6	0.7	16.6
Obukowin[6]	0.9	4.1	10.3	7.9	3.2	2.1	29.8
Aikens[6]	1.0	0.8	5.1	3.5	2.2	1.9	14.6

[1]Hagenson 1984.

[2]Hagenson 1983b.

[3]Hagenson 1983a.

[4]Hagenson and O'Connor 1981.

[5]Hagenson and O'Connor 1980.

[6]Hagenson and O'Connor 1979.

MANAGEMENT IMPLICATIONS

All of these lakes are small Precambrian Shield lakes and as such are quite low in productive capacity. Most of them except Apisko and Assapan are relatively unexploited. Due to the similarity of results from these lakes to other east side Lake Winnipeg lakes it is likely that the results of this inventory reflect the standing crop potential of these lakes.

Apisko and Assapan lakes have been commercially developed as outcamp lakes licenced for 8 beds each. The results of this inventory suggest that the harvest level on these lakes has not yet adversely affected the fish stocks of these lakes. However, given their small size and low productivity no increase in bed capacity should be considered.

Shallow Lake has been developed as a wild rice lake. The morphometry of the lake restricts the winter habitat available to fish. However, the netting results indicate that Shallow Lake is used as a summer feeding and nursery area for the fish stocks of that stretch of the Assapan River. Should future development of Shallow Lake's wild rice potential through impoundment and/or drainage be considered, the importance of the lake to the fish stocks of the area should also be reflected in any proposal.

The small size, low productivity and small standing crop of fish in Kagipo, Gilchrist, Whiskeyjack and Hallen lakes makes them unattractive to sport fish development such as outcamps. If they were considered as suitable outcamp lakes, they probably could not

support any sustained fishing pressure for too long without severely depressing the fish stocks in these lakes. Occassional day use by canoeists or fly-in anglers is probably the limit of these lakes potential.

RECOMMENDATIONS

1. No further development on, or expansion of existing facilities be considered for Apisko or Assapan lake.
2. Shallow Lake to remain as a wild rice lake.
3. Kagipo, Gilchrist, Whiskeyjack and Hallen lakes remain as remote wilderness lakes for day use only.

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Appendix 1. Catch summary of net sets 1 to 8 made in Apisko Lake.

Set Location	Date	Northern pike	Walleye	Yellow perch	Cisco	White Sucker	Whitefish	Total
1	July 29/79	4	26	-	43	10	-	83
2	July 29/79	4	34	2	34	11	-	85
3	July 30/79	4	39	2	15	8	-	68
4	July 30/79	5	22	3	14	6	-	50
5	July 31/79	3	25	-	25	7	1	61
6	July 31/79	5	20	1	20	10	-	56
7	July 03/80	2	15	1	7	5	-	30
8	July 03/80	3	14	10	24	3	2	56
Total Caught		30	195	19	182	60	3	489
Total sampled		30	195	19	182	60	3	489
Total aged		30	192					222

Appendix 2. Catch summary of net sets 1 to 4 made in Shallow Lake.

Set Location	Date	Northern pike	Walleye	White Sucker	Yellow Perch	Whitefish	Cisco	Total
1	July 28	5	24	11	19	1	-	60
2	July 29	5	28	1	25	1	7	67
3	July 30	2	18	10	9	1	2	42
4	July 31	12	35	7	35	-	-	89
Total caught		24	105	29	88	3	9	258
Total sampled		24	105	29	88	3	9	258
Total aged		24	105					129

Appendix 3. Catch summary of net sets 1 to 6 made in Assapan Lake.

Set location	Date of set	Northern pike	Walleye	Yellow perch	Cisco	White Sucker	Total
1	June 27	1	4	-	13	-	18
2	June 27	6	9	-	41	-	56
3	June 28	5	19	-	46	2	72
4	June 28	5	16	-	10	-	31
5	June 29	2	9	-	9	-	20
6	June 29	6	9	14	8	4	41
Total caught		25	66	14	127	6	238
Total samples		25	66	14	127	6	238
Total aged		25	64				89

Appendix 4. Catch summary of net sets 1 to 6 made in Kagipo Lake.

Set location	Date of Set	Northern Pike	Walleye	Yellow Perch	Whitefish	Cisco	White Sucker	Total
1	June 22	5	10	-	1	14	-	30
2	June 22	2	4	-	-	12	-	18
3	June 23	4	6	-	1	1	2	14
4	June 23	-	3	-	-	13	-	16
5	June 24	1	2	-	-	1	3	16
6	June 24	4	12	2	1	1	3	23
Total caught		16	37	2	3	54	5	117
Total sampled		16	37	2	3	54	5	117
Total aged		16	37					53

Appendix 5. Catch summary of net sets 1 to 6 made in Gilchrist Lake.

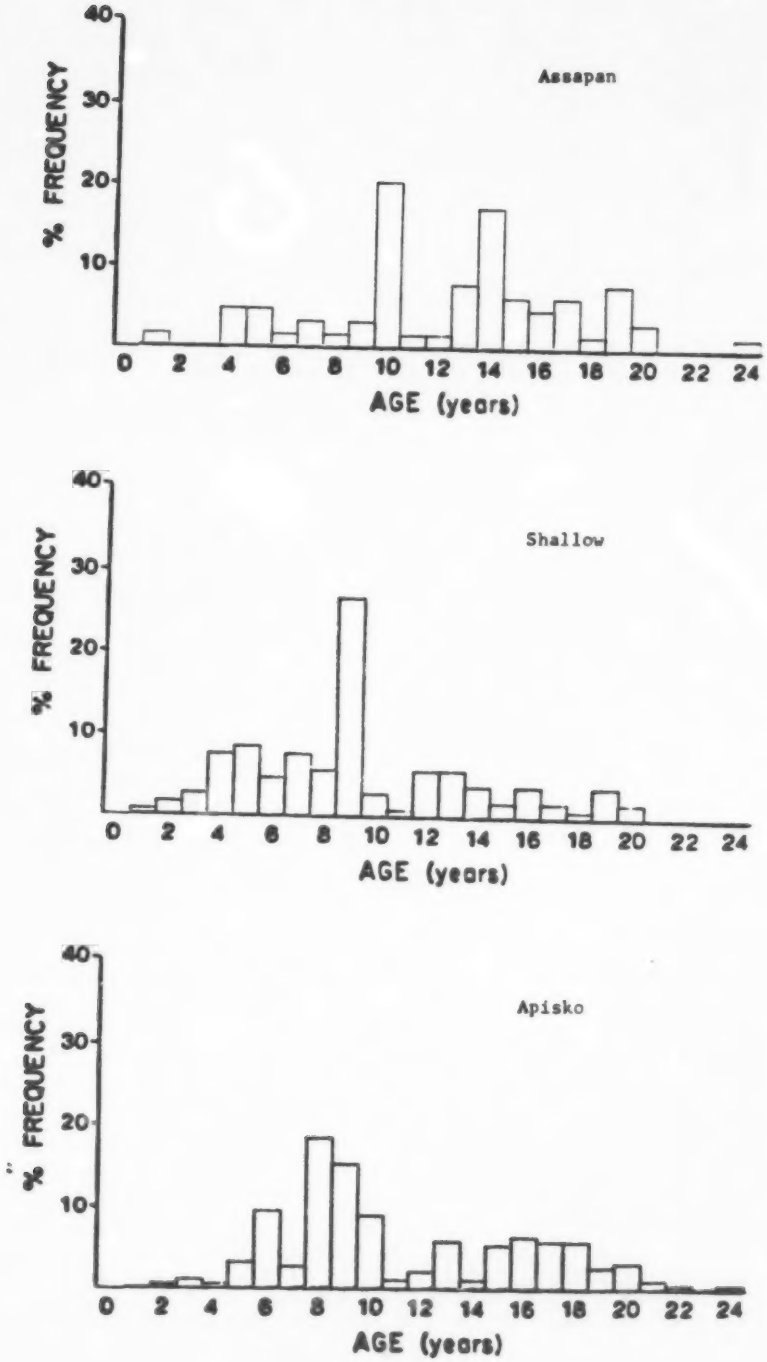
Set Location	Date of Set	Northern Pike	Yellow Perch	White Sucker	Total
1	June 12	26	-	13	39
2	June 12	19	2	11	32
3	June 13	4	3	2	9
4	June 13	13	-	11	24
5	June 14	17	1	13	31
6	June 14	14	1	1	16
Total caught		93	7	51	151
Total sampled		93	7	51	151
Total aged		93			93

Appendix 6. Catch summary of net sets 1 to 3 made in Whiskeyjack Lake.

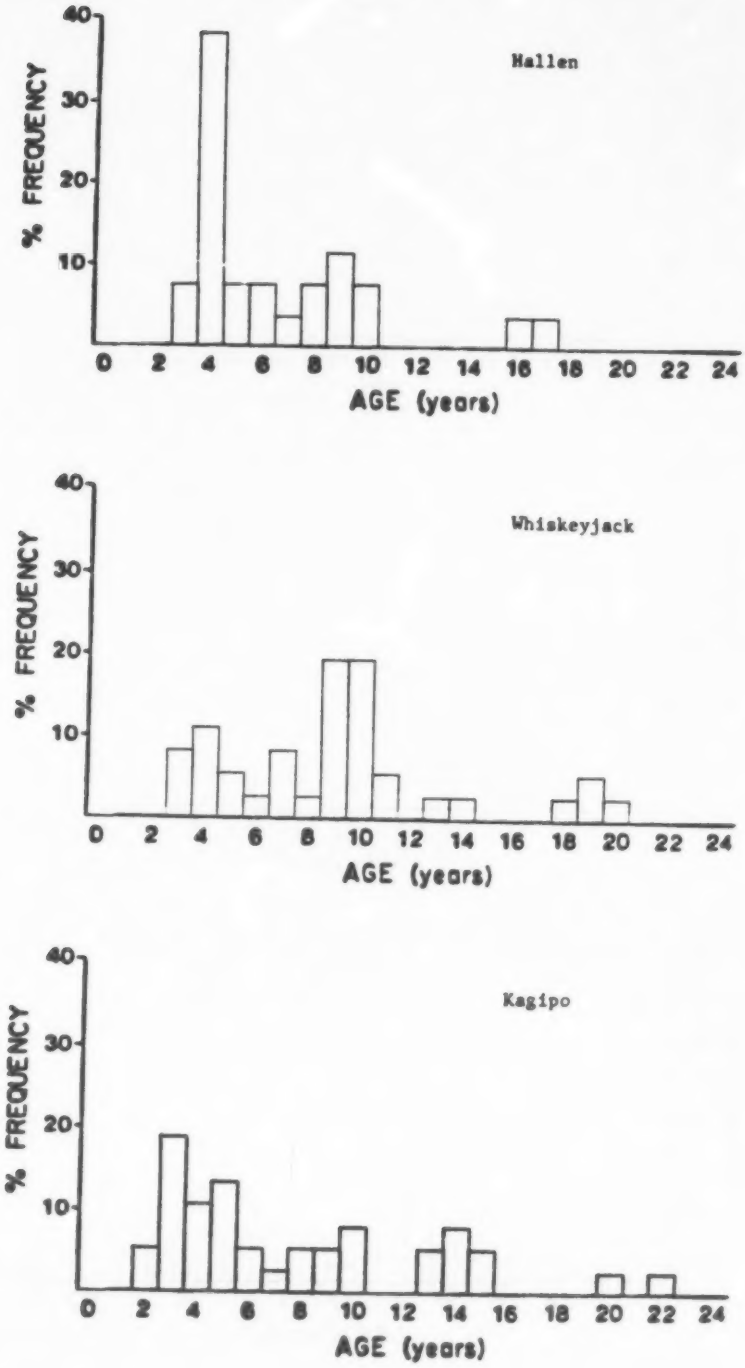
Set Location	Date of Set	Northern Pike	Walleye	White Sucker	Yellow Perch	Total
1	June 17	1	2	-	-	3
2	June 17	7	18	7	2	34
3	June 18	5	16	-	3	24
Total caught		13	36	7	5	61
Total sampled		13	36	7	5	61
Total aged		13	36			49

Appendix 7. Catch summary of net sets 1 to 3 made in Hallen Lake.

Set Location	Date of Set	Northern Pike	Walleye	White Sucker	Yellow Perch	Total
1	June 19	6	11	5	-	22
2	June 19	3	5	-	-	8
3	June 20	3	10	-	1	14
Total caught		12	26	5	1	44
Total sampled		12	26	5	1	44
Total aged		12	26			38



Appendix 8. Age-frequency distribution for walleye from Apisko, Shallow and Assapan lakes.



Appendix 9. Age-frequency distribution for walleye from Kagipo, Whiskeyjack and Hallen lakes.

Appendix 10. Age-specific length-weight relationships of walleye from the inventoried lakes.

Lake	Length-weight equation $\log_e$ weight = a + b $\log_e$ length	Correlation coefficient	Test F ratio and d.f.
Apisko	$\log_e Y = -10.432 + 2.825 \log_e X$	0.998	4438.28*(1,20)
Shallow	$\log_e Y = -12.690 + 3.205 \log_e X$	0.997	2640.72*(1,18)
Assapan	$\log_e Y = -11.663 + 3.043 \log_e X$	0.997	3294.30*(1,17)
Kagipo	$\log_e Y = -11.502 + 3.013 \log_e X$	0.997	2292.45*(1,12)
Whiskeyjack	$\log_e Y = -12.051 + 3.105 \log_e X$	0.998	2704.45*91,12)
Hallen	$\log_e Y = -11.715 + 3.039 \log_e X$	0.992	521.51*91,8)

* Significant of $P \geq 0.05$.

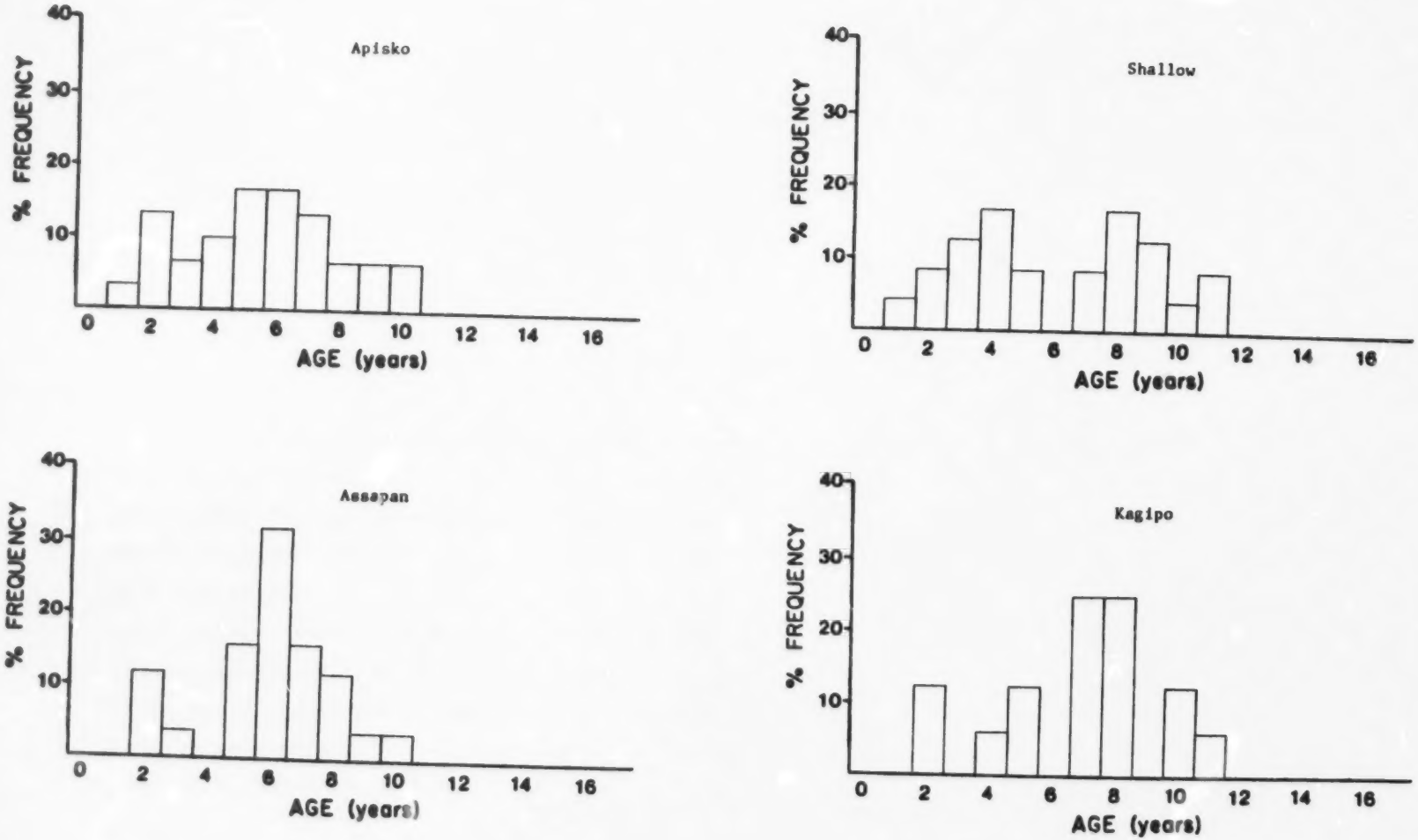
Appendix 11. Exponential growth curves for walleye from the lakes inventoried.

Lake	Log_e length = a + b Log_e age	Age range (years)	Correlation coefficient	Test F ratio and d.f.
Apisko	$\log_e = 5.137 + 0.301 \log_e$ age	2-22	0.918	106.48*(1,20)
Shallow	$\log_e = 5.053 + 0.338 \log_e$ age	2-20	0.979	406.31*(1,18)
Assapan	$\log_e = 5.077 + 0.388 \log_e$ age	4-20	0.964	226.37(1,17)
Kagipo	$\log_e = 4.621 + 0.574 \log_e$ age	2-15	0.992	759.29*(1,12)
Whiskeyjack	$\log_e = 4.957 + 0.389 \log_e$ age	2-19	0.934	82.29*(1,12)
Hallen	$\log_e = 5.026 + 0.350 \log_e$ age	1-10	0.949	71.76*(1,18)

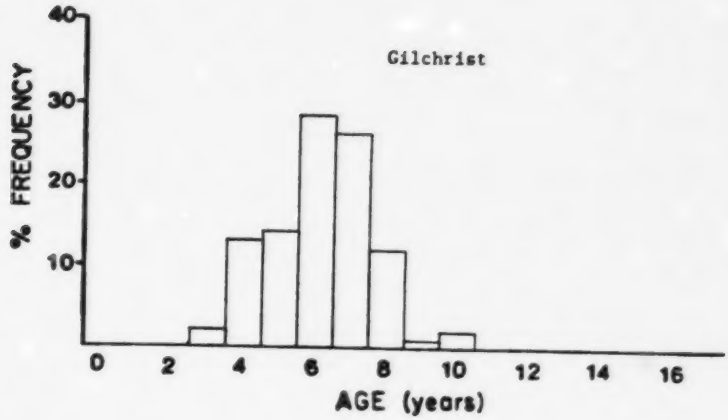
*Significant at $P \geq 0.05$.

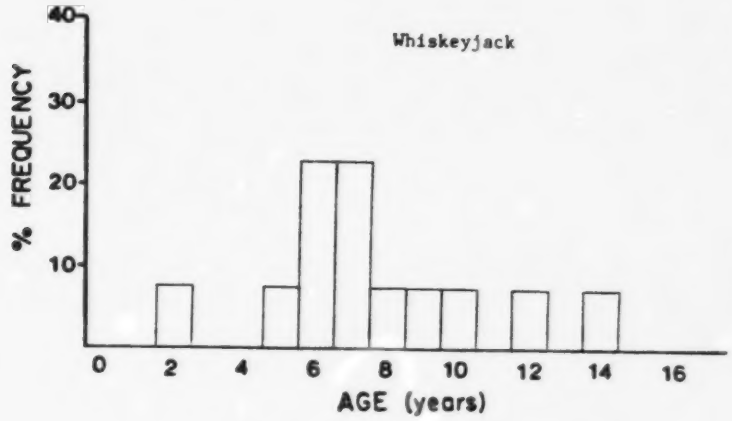
Appendix 12. Maturity data for walleye from the inventoried lakes.

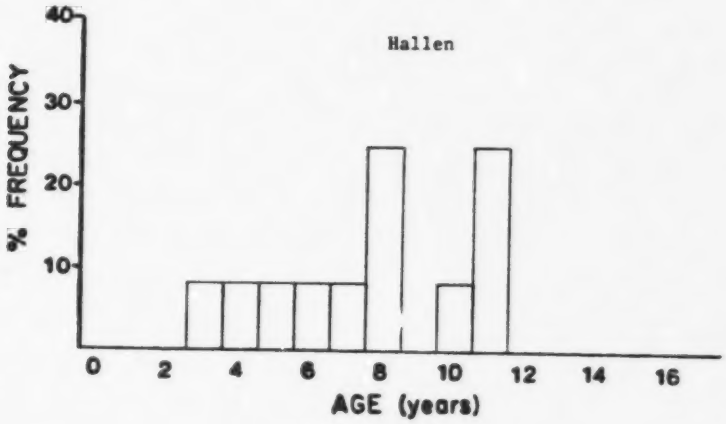
	Apisko	Shallow	Assapan	Kagipo	Whiskeyjack	Hallen
Sex ratio (males to females)	1:1.25	1:2	1:3	1:2.1	1:4.1	1:0.6
Percent males mature	20.0	20.0	56.2	16.7	0	12.5
Mean length mature males (mm)	379	361	418	414	-	366
Percent females mature	83.2	52.8	79.2	52	75.9	60
Mean length mature females (mm)	380	383	457	446	384	338
Mean age of maturity (Z)	9.9	10.9	8.5	8.5	9.0	6.5
Age at 100% maturity	12	14	9	10	9	7
Mean length at 100% maturity	400	394	368	382	362	334
Mean age of sample	11.3	9.3	12.5	7.8	9.1	5.7



Appendix 13. Age-frequency distribution for northern pike from Apikso, Shallow, Assapan and Kagipo lakes.







Appendix 14. Age-frequency distribution for northern pike from Gilchrist, Whiskeyjack and Hallen lakes.

Appendix 15. Age-specific length-weight relationships for northern pike from the inventoried lakes.

Lake	Length-weight equation $\log_e$ weight = a + b $\log_e$ length	Correlation coefficient	Test F ratio and d.f.
Apisko	$\log_e Y = -12.550 + 3.104 \log_e X$	0.995	799.59*(1,8)
Shallow	$\log_e Y = -12.954 + 3.157 \log_e X$	0.999	2979.43*91,8)
Assapan	$\log_e Y = -9.898 + 2.684 \log_e X$	0.997	1110.07*(1,6)
Kagipo	$\log_e Y = -11.903 + 3.000 \log_e X$	0.998	1520.70*(1,5)
Gilchrist	$\log_e Y = -13.512 + 3.251 \log_e X$	0.998	1399.04*(1,6)
Whiskeyjack	$\log_e Y = -11.608 + 2.961 \log_e X$	0.998	1858.68*(1,7)
Hallen	$\log_e Y = -12.656 + 3.119 \log_e X$	0.999	2566.47*(1,9)

*Significant at $P \geq 0.05$.

Appendix 16. Exponential growth curves for northern pike from the inventoried lakes.

Lake	$\log_e$ length = a + b $\log_e$	Correlation coefficient	Age range (years)	Test F ratio and d.f.
Apisko	$\log_e$ length = 5.470 + 0.507 $\log_e$ age	0.985	3-10	259.49*(1,8)
Shallow	$\log_e$ length = 5.208 + 0.661 $\log_e$ age	0.976	3-11	161.28*(1,8)
Assapan	$\log_e$ length = 5.444 + 0.481 $\log_e$ age	0.924	5-10	35.20*(1,6)
Kagipo	$\log_e$ length = 5.019 + 0.715 $\log_e$ age	0.986	4-10	176.61*(1,5)
Gilchrist	$\log_e$ length = 5.421 + 0.557 $\log_e$ age	0.968	3-08	89.24*(1,6)
Whiskeyjack	$\log_e$ length = 5.018 + 0.723 $\log_e$ age	0.979	5-12	160.65*(1,7)
Hallen	$\log_e$ length = 5.155 + 0.669 $\log_e$ age	0.965	3-08	82.12*(1,6)

*Significant at $P \geq 0.05$.

Appendix 17. Maturity data for northern pike from the inventoried lakes.

	Apisko	Shallow	Assapan	Kagipo	Whiskeyjack	Hallen	Gilchrist
Sex ratio (males to females)	1:4	1:2	1:0.6	1:1.7	1:5.5	1:2	1:2.25
Percent males mature	16.7	12.5	81.2	83.3	100	100	89.3
Mean length mature males (mm)	590	412	568	616	651	575	582
Percent females mature	66.7	75.0	100	90	90.9	100	96.8
Mean length mature females (mm)	643	800	593	662	675	721	697
Mean age of maturity (%)	5.3	6.7	4.2	4.2	5.0	3.0	3.9
Age at 100% maturity	7	7	5	5	5	3	5
Mean length at 100% maturity	682	822	470	458	552	370	591
Mean age of sample	5.5	6.0	5.9	6.8	7.6	7.7	6.1